

International Macadamia Symposium 2023



IMS'23

MOVING FORWARD TOGETHER

Macadamias South Africa (NPC)
(SAMAC)



*Phytophthora and
Phytopythium species
in the macadamia
industry*

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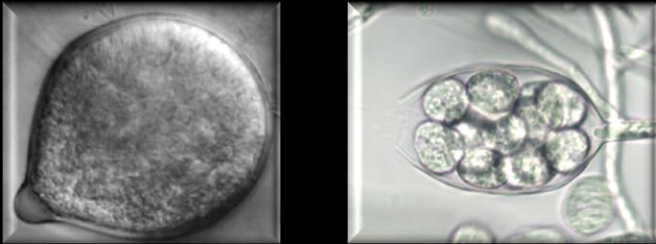
Content

- Introduction
- Oomycete species associated with macadamia in South Africa
- Pathogenicity of isolates
- Detecting *Phytophthora* and *Phytopythium* spp. in environmental samples

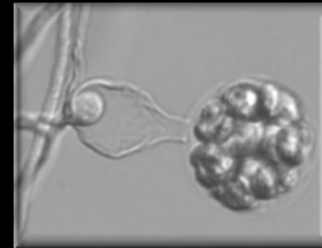
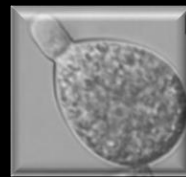


Oomycete Genera Soilborne Diseases

Phytophthora spp.



Phytophthora cinnamomi
Root rot and stem canker of
macadamia (slow decline)

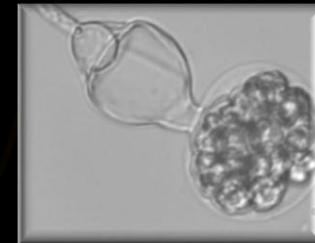
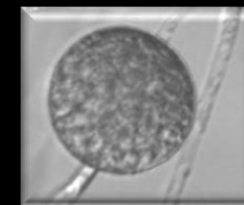


Phytophthora multivora – Stem canker and root rot
Phytophthora hevea & *P. tropicalis* – Quick decline
Phytophthora palmivora – Phytophthora blight
Phytophthora tropicalis – Quick decline

Pythium spp. (> 150 spp.)
pathogenic, non-pathogenic,

Phytopythium

Pythium



Globisporangium



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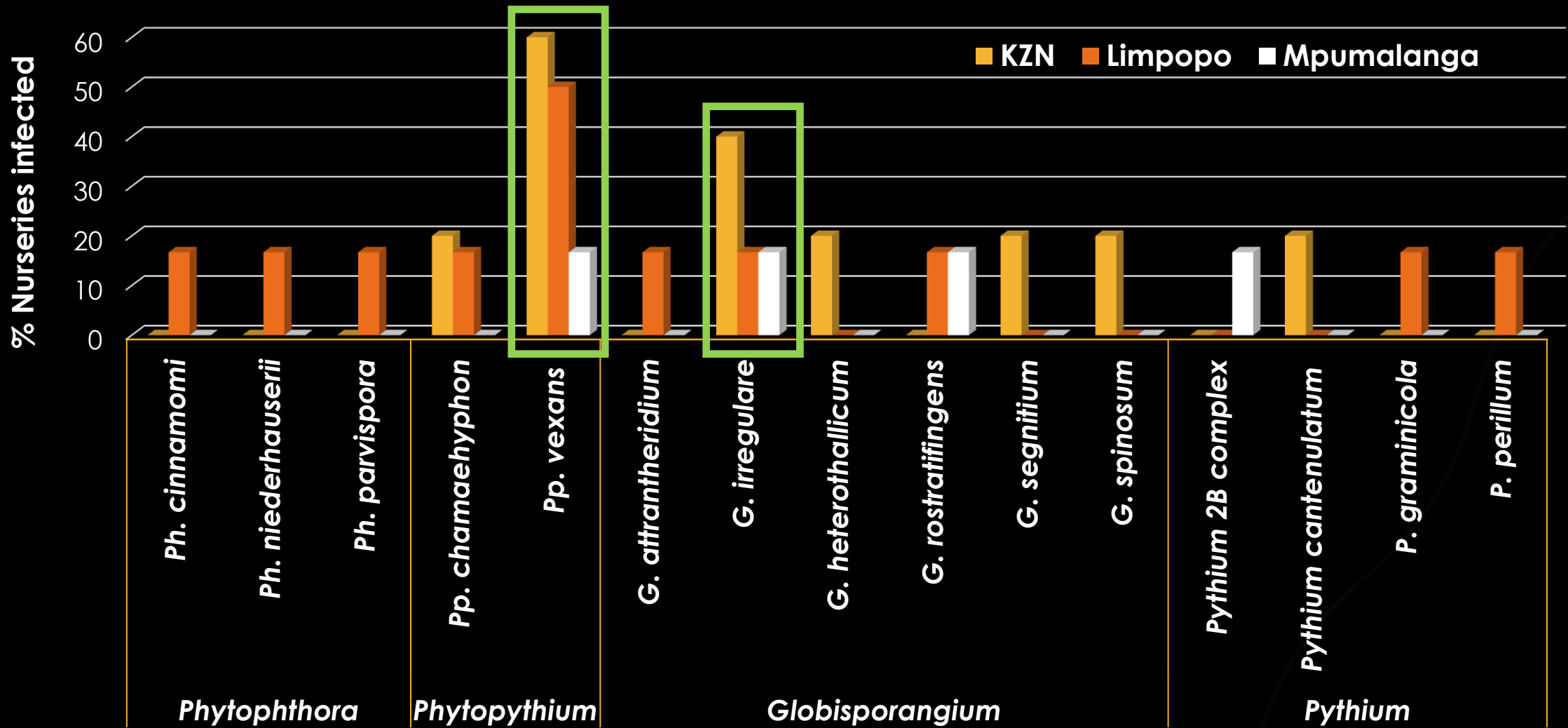
Survey Oomycete Species associated with macadamia in South Africa

- Focus on identifying root rot pathogens
- Roots collected in main production regions (Mpumalanga, Kwazulu-Natal and Limpopo)
 - 17 Nurseries – 170 plants
 - 21 Young orchards – 105 trees
 - 20 Old orchards – 60 trees
- Stem cankers only sampled in Mpumalanga - 6 orchards



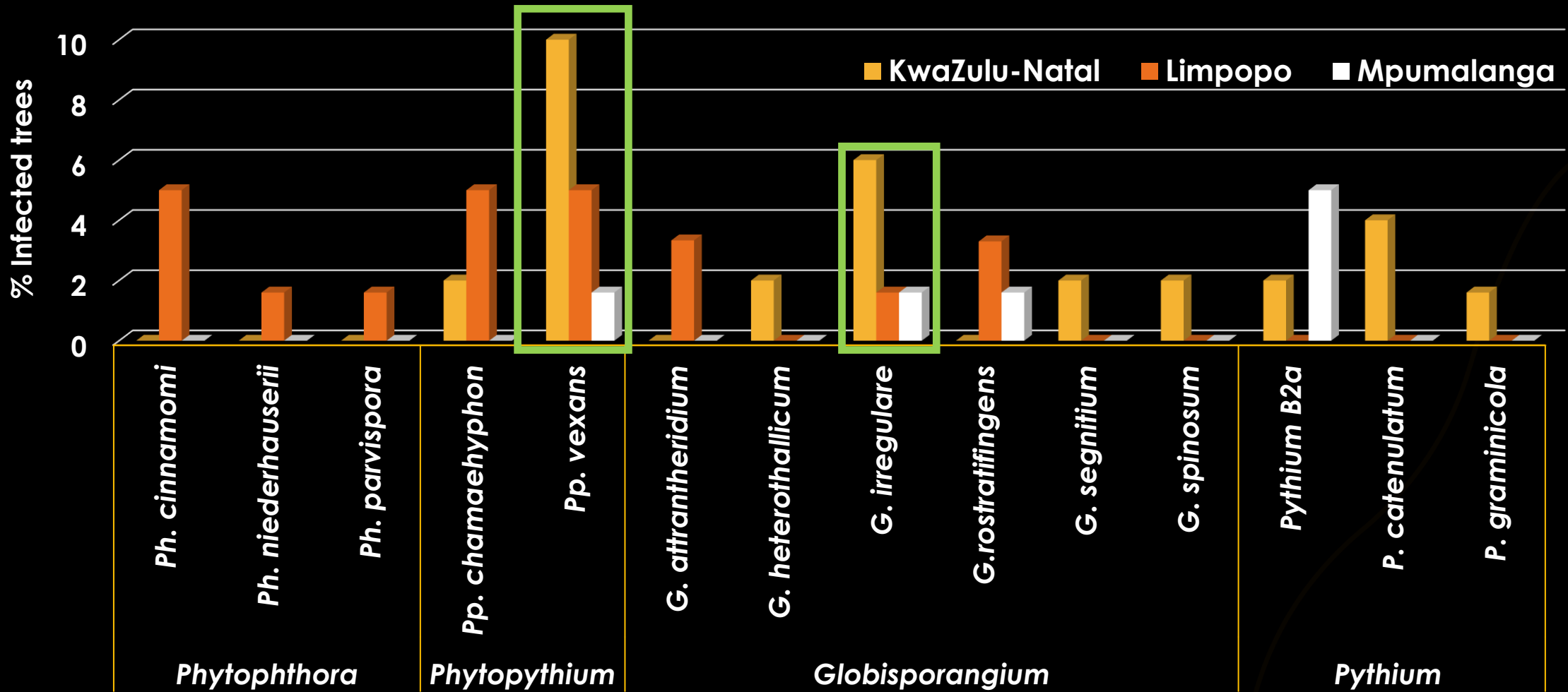
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Oomycete species identified in Nurseries – Percentage Nurseries infected

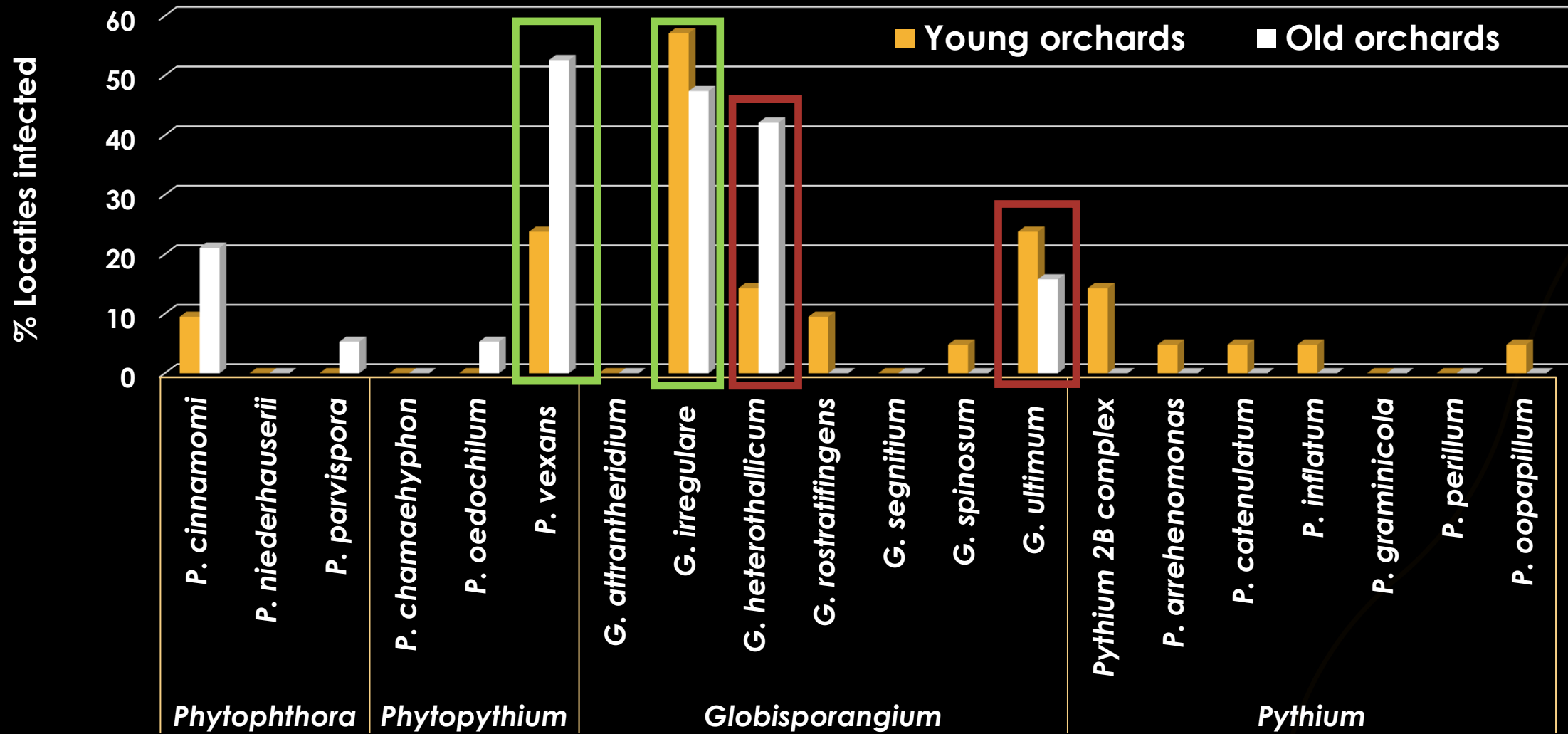


Oomycete species identified in Nurseries

Percentage Plants infected Nurseries



Oomycete species in Young orchards and Old orchards



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What is known about the most commonly occurring species?

Globisporangium irregulare

Globisporangium heterothallicum

Globisporangium ultimum

- No reports on macadamia
- Root rot pathogen of apple and grapevines
- Commonly occurs in soils, also known for causing damping-off annual crops

Phytophthium vexans

- Significant reduction in root mass of one-year-old 'Beaumont' trees, sometimes as severe *Ph. cinnamomi* (Serfontein *et al.*, 2007)
- Stem cankers macadamia when inoculated into soil (Serfontein 2007)
- Root- and collar rot pathogen other tree crops including apple & kiwi vines



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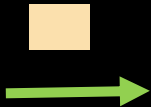
Investigating pathogenicity macadamia isolates

Stem inoculation trials

Ph. cinnamomi & *Pp. vexans*



Oomycete isolate



Parameters:

- Stem lesion length

Root inoculation trials

Ph. cinnamomi, *Pp. vexans*
& *Globisporangium* spp.



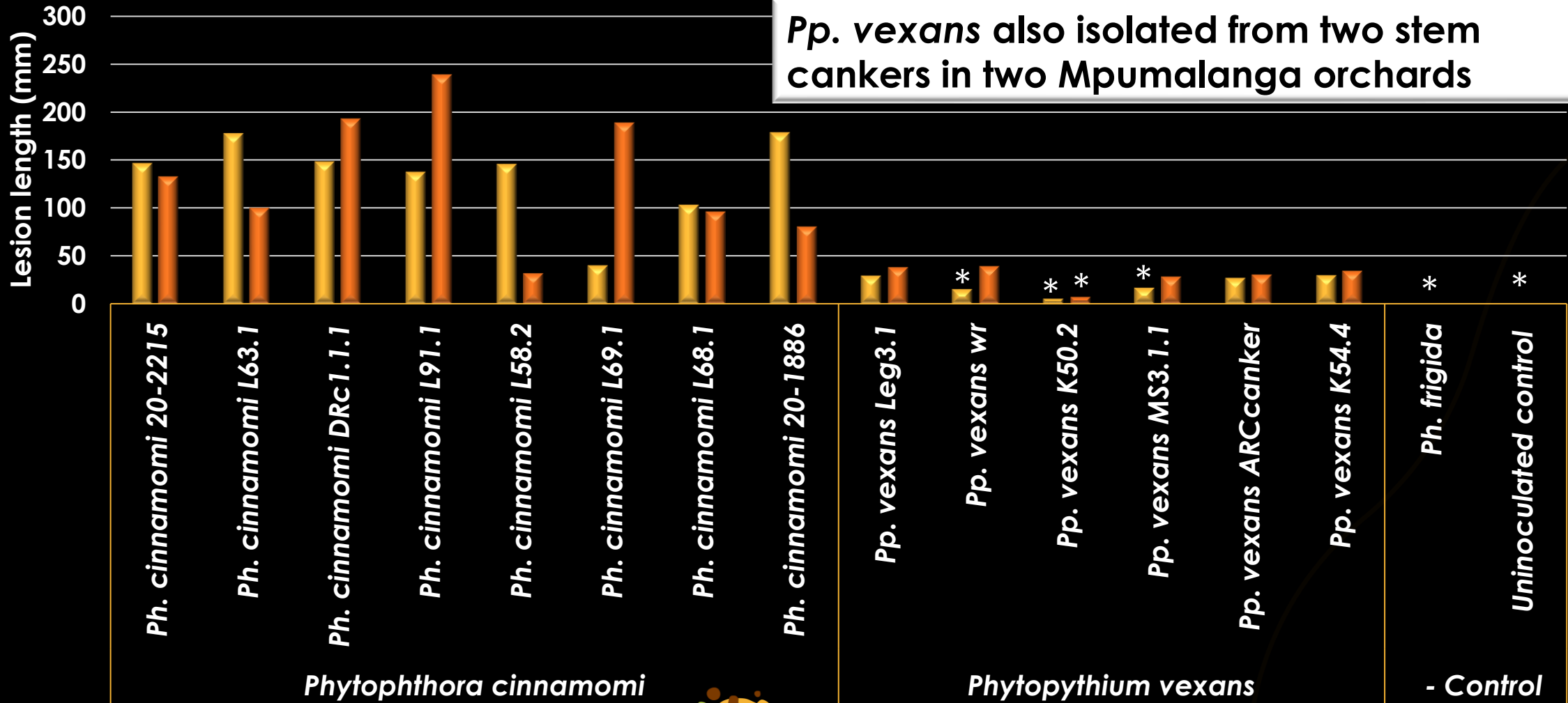
Parameters: **Trials still in progress**

- Increase in seedling length
- Increase in plant weight
- Root weight



Stem inoculation trial results

Pp. vexans also isolated from two stem cankers in two Mpumalanga orchards



* = significantly lower other treatments



Detecting *Ph. cinnamomi* & *Pp. vexans* in nurseries

Inoculum sources in nurseries

Irrigation water



Dust on shade nets



Plant growth substrate



- Identifying *Pp. vexans*
- False negatives for *Ph. cinnamomi* due to overgrowth other fast growing oomycete spp.

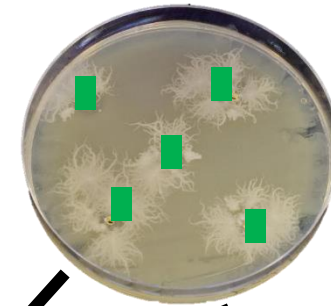
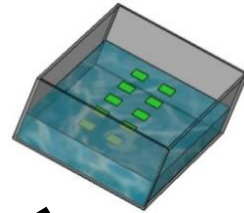


Detecting Methods for *Phytophthora* spp.



Conventional baiting

Leaf disks



Leaf disks planted
Semi-selective medium

Leaf disk
DNA
extraction



qPCR



DNA extraction
mycelia on plate



qPCR

qPCR for specific
species

Morphological identification based
on mycelial morphology

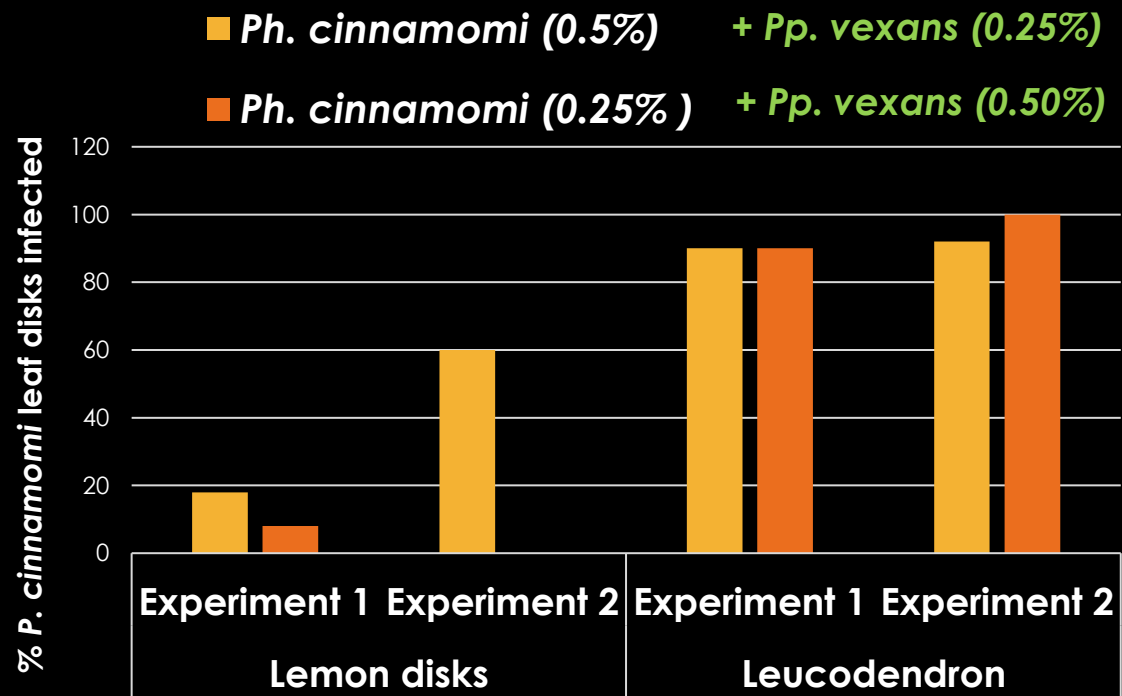


Ph. cinnamomi ✓

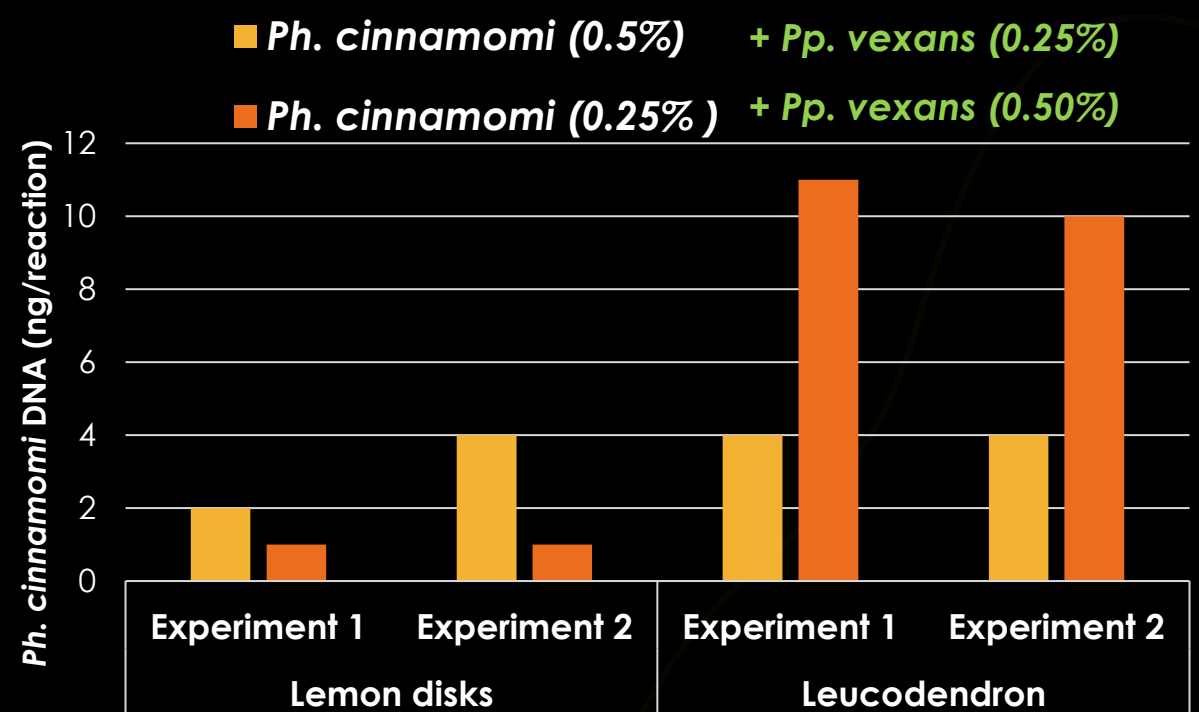
Pp. vexans ✗

Can *Ph. cinnamomi* be detected in presence of *Pp. vexans* (other oomycetes) ?

Conventional baiting & plating



qPCR of mycelia on plates

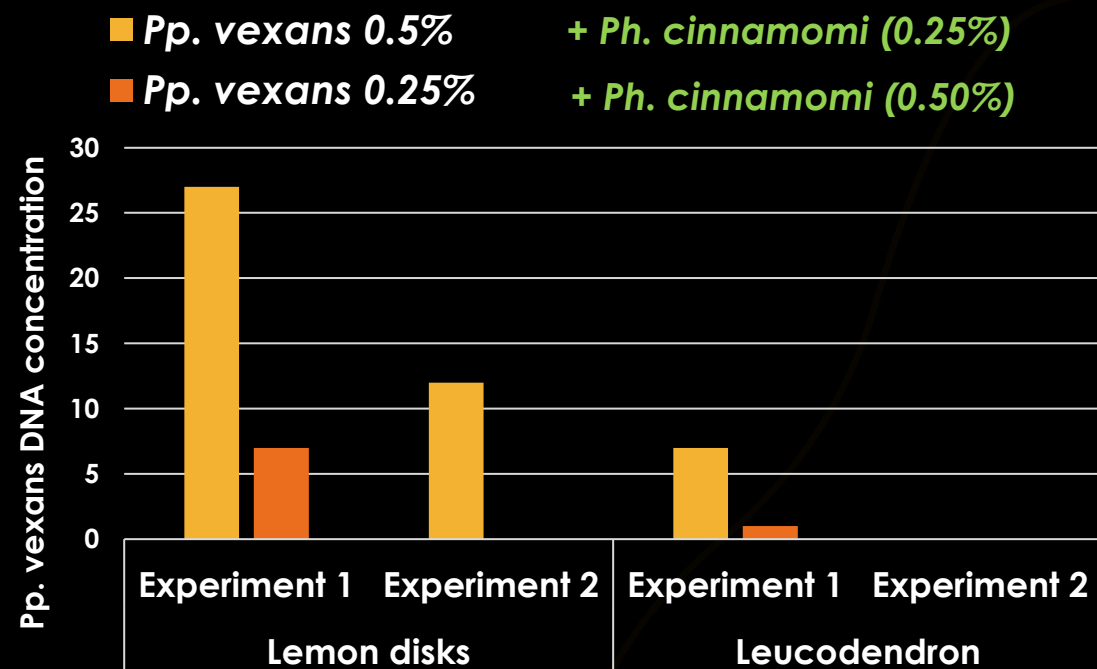


Can *Pp. vexans* be detected in presence of *Ph. cinnamomi* ?

Conventional baiting & plating



qPCR of mycelia on plates





Conclusions

- **Oomycetes associated with macadamia**
 - *Phytophthium vexans* stem and root rot pathogen of macadamia
 - Three *Globisporangium* spp. potential root rot pathogens of macadamia
- **Detection of *Ph. cinnamomi* and *Pp. vexans***
 - Leaf disk type influence efficacy of detection *Pp. vexans* and *Ph. cinnamomi*
 - Molecular (qPCR) detection may be more sensitive



Future Research

- Root rot pathogenicity testing *Pp. vexans* and *Globisporangium* spp.
- Testing commercial nursery growth media – standard vs molecular detection methods
- Evaluating potential and optimization of molecular detection (qPCR) for use in commercial testing ?



Acknowledgements

SAMAC – Funding



Maritha Schoeman – ARC

Andrew Sheard – Mayo Macs

Chris Spies - ARC

Kayleigh Carter

MSc

PhD candidate

